The effect of ground application of organic and chemical fertilizer on the growth and yield of roses

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Abstract

The field experiment was carried out in the 2022-2023 growing season in one of the greenhouses affiliated with the research station of the Soil and Water Resources Department, College of Agriculture, University of Diyala. The experiment was conducted for the period from 1/11/2022 to 1/4/2023, studying the effect of adding three levels of NPK fertilizer. R.C.B.D. system of practical experiments based on random selection. the experience is the result two factors. The first factor was three levels of NPK(20:20:20) fertilizer, which are the symbols for the treatments M0, M1, and M2, respectively (0, 50, 100 gm).The second factor was three levels of organic fertilizer. The symbols for the transactions are respectively O0, O1, O2 (0, 5, 10 gm. Liter^{-1}., all three of them were repeated as replicates if the number of experimental units reached 27 experimental units.

Statistical analysis of the studied traits was performed according to the selection using SPSS program and a test conducted using Duncan's multinomial test at the probability level of 0.05. The results showed the effect of chemical and organic fertilizer on, plant height, number of branches, number of flowers, number of leaves, stem thickness, and plant weight if it affects increase in adding organic fertilizer when the level of O2 addition in leaf area, stem height, number of branches, and number of leaves reached, respectively178.33, 29.50 cm, 5.00 (plant branch-1), and 178.33 leaf Palnt $^{-1}$. As for the effect of chemical fertilizer, excelled in plant height, number of flowers, number of leaves, percentage of chlorophyll, stem thickness, and plant weight, each of which reached 31.50 cm and 3.83 (flower plant^{-1}) respectively. 193.83 leaf plant $^{-1}$,40.81 spad, 2.03 cm, and 4.25 kg , while it is noted that in the interaction between the organic and chemical fertilizer additions, the M2O2 and M1O2 interaction coefficients exceeded the M2O0 treatment excelled in the number of branches, number of flowers, number of leaves, percentage of chlorophyll, stem thickness, and plant weight, each of which reached, respectively, 5.50 branch plant^{-1}, 5.00 flowers per plant^{-1}, 200.50 leaves plant^{-1}, 43.90 spad. 2.70 cm and 4.65 kg.

Key word: Organic fertilizer, Chemical fertilizer, Ground application,Rose.

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1Introduction

The rose plant (*Rosa* sp) Rose is a shrubby or climbing plant that grows wild in all parts of the earth except hot areas. It is rare for a garden to be without it, regardless of its type. Independent gardens are also designated for it called (rose gardens). The rose plant belongs to the family Rosaceae. It is one of the oldest known flowers, and some consider it the first flower that humans were interested in cultivating. For this reason, most of the plants currently in existence are hybrid plants, and more than 200 species are now known. Rose flowers are widely accepted by consumers due to the wide diversity in flower color, shape, growth habits, and plant size. Cut roses generally represent approximately 39% of total cut flower sales in the United States of America, and there is a great demand for rose flowers for Valentine's Day and Christmas.

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Moreover, cut rose flowers are commonly used on many religious and social occasions such as marriage, birthdays, and social gatherings and are exchanged between loved ones (1) Chemical fertilizers are manufactured chemical substances that work to improve plant nutrition (growth and increase production in addition to improving the quality of the yield), as the plant needs the necessary macro and micro nutrients in order to continue to grow and develop because they are effective in vital processes and are involved in many important compounds that contribute In the metabolic processes of the plant, its use leads to an increase in production to about 50%, provided that there is a balance when adding it, including the major elements (NPK), which are considered important in the continued growth of the plant, especially in the vegetative growth stage, flowers and nodes, with absorption rates equal to the growth rates, and the plant needs Nitrogen in the early stages of its growth, as it works to build an efficient vegetative system, and has many important physiological functions, as it is involved in the formation of amino acids, which are considered the cornerstone of protein formation (2). However, the effects of chemical fertilizers include if they are not when used inappropriately, they contribute to global climate change, degradation of soil, water resources and air quality, depletion of nutrients from soil and potential harm to human, animal and soil health. A number of studies have emphasized that disturbances to the biological, geographical and chemical flows of nitrogen and phosphorus due to their production for use agricultural crops have exceeded the safe margin of human activity (3). The use of fertilizers and nutrients from organic sources in agriculture at the same time is necessary as a result of increasing consumer demand for certified organic products. Organic fertilizers are various raw materials, such as animal remains and plant by-products, plant residues, and algae. These types of fertilizers are rarely available. They require bacterial decomposition in order to obtain the nutrient content, and therefore they can be described as slow-degrading fertilizers (4). The use of liquid organic fertilizers is considered a major development because they provide the necessary elements to increase plant efficiency and improve the course of vital activities within the plant, which is reflected in growth. Active materials: Micronutrients, including iron, play an important role in plant life, as they increase the strength of the plant and increase the process of carbon metabolism, respiration, and other biochemical and physiological activities by converting these materials into very small parts to facilitate the absorption process by the plant and increase its chemical reactions. Biological plants provide the plant and soil with elements for a longer period of time and reduce soil pollution problems resulting from the use of excess fertilizers(5,6)

The purpose of the study are:

Knowing the effect of fertilizers (organic and chemical) on vegetative and yield characteristics of rose plants

2- Materials and methods

The field experiment was carried out in the 2022-2023 growing season in one of the greenhouses affiliated with the research station of the Soil and Water Resources Department, College of Agriculture, University of Diyala. The experiment was conducted for the period from 11/1/2022 to 4/1/2023, studying the effect of adding three levels of NPK fertilizer. And three levels of organic fertilizer in the growth of the shrub rose plant. The experiment included two factors. The first

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factor was three levels of NPK fertilizer, which are the symbols for the treatments M0, M1, and M2, respectively (0,50,100 gm). The second factor was three levels of organic fertilizer. The symbols for the transactions are respectively O0, O1, O2 (0,5,10 gm. liter^{-1}). The seedlings were purchased from one of the private nurseries in Diyala Governorate.

Studied attributes

Plant height (cm)

Plant height was measured using a measuring tape, and the height was taken from the stem contact area plant on the surface of the soil of the pot to the end of the top of the plant

Number of branches(branch Plant^{-1})

The number of branches was manually counted for the treatment plants and then the average was calculated.

The thickness of the stem (cm)

The stem thickness measurement was chosen for each plant in the experimental unit, then the stem diameter measurement was taken from the highest area contacting the soil with (Vernir) and then calculating the average.

Number of leaves (leaf plant $^{-1}$)

The number of leaves was manually counted for each plant in the experimental unit, and then the average was calculated

Relative Chlorophyll content(SPAD UNIT).

The relative chlorophyll content in leaves was estimated using the manufactured SPAD 502 device from Minolta Perkins.

Number of flowers(flower Plant^{-1})

The number of Flowers was manually counted for the treatment plants and then the average was calculated.

Weight of one plant (kg) (fresh weight).

These measurements were performed on 4 plants from each replicate, 50 days after planting.

Experimental design:

R.C.B.D. system of practical experiments based on random selection. the experience two factors. The first factor was three levels of NPK fertilizer, which are the symbols for the treatments M0, M1, and M2, respectively (0,50,100 gm). The second factor was three levels of organic fertilizer. The symbols for the transactions are respectively O0, O1, O2 (0,5,10 gm. Liter^{-1})., all three of them were repeated as replicates if the number of experimental units reached 27 experimental units.

Statistical analysis of the studied traits was performed according to the selection using SPSS program. and the a test condected using Duncan's multinomial test at the probability level of 0.05.

3- Results and discussion

Table (1) shows the effect of chemical and organic fertilizer on plant height (cm), as the treatment of adding organic fertilizer excelled at the O2 level and recorded the highest plant height of 29.50 cm compared to the control treatment, which recorded the lowest value of plant height of 22.83 cm. As for the treatment of adding chemical fertilization The addition treatment excelled at the M2 addition level, which recorded the highest value for plant height, which reached 31.50 cm, compared to the control, which reached 22.00 cm. Through interaction, we note the superiority of the O1M2 and O2M2 treatments, which recorded the highest value for plant height, which reached 33.50 and 34.50 cm, respectively, compared to the control treatment, which recorded The lowest plant height was 19.50 cm.

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Table (1) the effect of chemical and organic fertilizer on plant height (cm)

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
22.00 c	25.50 c	21.00 de	19.50 e	M0
25.83 b	28.50 b	26.50 bc	22.50 d	M1
31.50 a	34.50 a	33.50 a	26.50 bc	M2
Average effect of organic fertilization treatments	29.50 a	27.00 b	22.83 c	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

Table (2) shows the effect of chemical and organic fertilizer on the number of branches, as the treatment of adding organic fertilizer at the level of adding O2, which recorded the highest number of branches, which reached 5.00 (branch plant $^{-1}$), was superior to the treatment of adding Compared to the control treatment, which gave the lowest number of branches, 2.83 branches per plant-1 fertilizer chemically, there are no significant differences, as all treatments are superior, while it is clear from the effect of the interaction between organic fertilizer and chemical fertilizer that the interaction treatment at the O2M2 level, which recorded the highest number branch and reached 5.50 (branch plant $^{-1}$), was superior to the control treatment, which recorded the lowest number of branches. 2.00 (branch plant $^{-1}$)

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Table (2) the effect of chemical and organic fertilizer on the number of branches (branch plant $^{-1}$)

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
3.50 A	5.00 ab	3.50 bcd	2.00 D	M0
4.00 A	4.50 abc	4.50 abc	3.00 cd	M1
4.33 A	5.50 a	4.00 abc	3.50 bcd	M2
Average effect of organic fertilization treatments	5.00 a	4.00 b	2.83 C	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

is noted from Table (3) the effect of chemical and organic fertilizer on stem thickness (cm), as the O2 treatment, which recorded the highest stem thickness of 2.13 (cm), outperformed the control treatment, which recorded the lowest stem thickness of 1.06 (cm). As for the addition treatment chemical fertilizer: It is noted that the M2 treatment, which recorded the highest stem thickness of 2.03 (cm), was superior to the treatments M0 and M1, which recorded the lowest stem thickness, amounting to 1.43 and 1.41 (cm), respectively, while it is noted that the interaction treatment between organic fertilizer and chemical fertilizer is superior to the O2M2 interaction treatment. Which recorded the highest leg thickness at a level of 2.70 (cm) in the control treatment, which recorded the lowest stem thickness of 0.85 cm.

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Table (3) the effect of chemical and organic fertilizer on stem thickness (cm)

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
1.43 B	2.00 b	1.45 c	0.85 E	M0
1.41 B	1.70 bc	1.55 c	1.00 de	M1
2.03 A	2.70 a	2.05 b	1.35 cd	M2
Average effect of organic fertilization treatments	2.13 a	1.68 b	1.06 c	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

It is clear from Table (4) that the effect of chemical and organic fertilizer on the number of leaves per plant exceeds the treatment of adding organic fertilization at the level of adding O2, which recorded the highest number of leaves, reaching 178.33 (leaves plant $^{-1}$)over the comparison treatment O0, which recorded the lowest number of leaves, amounting to 149.00 (leaves plant $^{-1}$). As for the treatment of adding chemical fertilizer, it is noted that the addition treatment M2, which recorded the highest number of leaves, amounting to 193.83 (leaves plant $^{-1}$), while the control treatment recorded the lowest number of leaves. It reached 142.00 (leaves plant $^{-1}$), while the interaction between organic fertilizer and chemical fertilizer shows the superiority of the interaction treatment at the level of adding O2M2, which recorded the highest number of leaves, amounting to 200.50 (leaves plant $^{-1}$), over the control treatment O0Mo , which amounted to 126.00(leaves plant $^{-1}$).

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Table (4) that the effect of chemical and organic fertilizer on the number of leaves(leaves plant $^{-1}$)

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
142.00 C	155.00 d	145.00 de	126.00 F	M0
156.50 B	179.50 c	154.50 d	135.50 Ef	M1
193.83 A	200.50 a	195.50 ab	185.50 Bc	M2
Average effect of organic fertilization treatments	178.33 a	165.00 b	149.00 C	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

Table (5) shows the effect of chemical and organic fertilizer on the percentage of chlorophyll (SPAD), as the two organic fertilizer treatments excelled at the level of adding O1 and 02, which recorded the highest percentage of chlorophyll of 37.98 and 39.68 (SPAD) over the control treatment O0, which amounted to 34.93 (SPAD). As for the chemical fertilizer addition treatment, the addition treatment at the M2 level was superior and recorded the highest percentage of chlorophyll of 40.81 (SPAD) on the control treatment M0 and the addition treatment at the M1 level, which recorded the lowest percentage of chlorophyll, amounting to 35.16 and 36.61 (SPAD), respectively, while it is noted from the interaction between the two addition treatments of organic fertilizer and chemical fertilizer, in which the interaction treatment O2M2 excelled, which recorded the highest percentage of chlorophyll, amounting to 43.90 (SPAD) on the O0M1 addition treatment, which recorded the lowest percentage of chlorophyll, reaching 32.80 (SPAD).

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Table (5) the effect of chemical and organic fertilizer on the percentage of chlorophyll (spad)

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
35.16 B	35.30 de	35.65 de	34.55 De	M0
36.61 B	39.85 bc	37.20 dc	32.80 E	M1
40.81 A	43.90 a	41.10 ab	37.45 Dc	M2
Average effect of organic fertilization	39.68 a	37.98 a	34.93 B	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

Table (6) shows the effect of organic and chemical fertilizer on the number of flowers (flower plant^{-1}). as the two organic fertilizer treatment excelled at the level of adding o1 and o2which recorded the highest percentage of number of flowers

3.16 and 3.66 (flowerplant^{-1}), respectively, wile comparison treatment O0, which recorded the lowest number of flowers. 1.83 (flowerplant^{-1}). As for the organic fertilizer treatment, it is noted that the addition treatment at the M2 level, which recorded a number of flowers of 3.83 (flowerplant^{-1}), was superior to the control treatment M0, which recorded the lowest number of flowers of 2.00 (flowerplant^{-1}), while The interaction between organic fertilizer and chemical fertilizer shows the superiority of the interaction treatment at the level of O2M2, which recorded the highest number of flowers of 5.00 (flowerplant^{-1}), over the control treatment O0M0, which recorded the lowest number of flowers of 1.00 (flowerplant^{-1}).

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Table (6) the effect of organic and chemical fertilizer on the number of flowers (flower of plant^{-1})

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
2.00 C	2.50 cd	2.50 cd	1.00 E	M0
2.83 B	3.50 bc	3.00 bcd	2.00 de	M1
3.83 A	5.00 a	4.00 ab	2.50 cd	M2
Average effect of organic fertilization treatments	3.66 a	3.16 a	1.83 B	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

Table (7) shows the effect of chemical and organic fertilizer on plant weight (kg), as the organic fertilizer addition treatment, which recorded the highest plant weight at the O2 level, amounting to 4.08 (kg), outperformed the control treatment, which recorded the lowest plant weight, amounting to 3.28 (kg). As for the chemical fertilizer addition treatment, the M2 addition treatment was superior and recorded the highest plant weight of 4.25 (kg)compared to the comparison treatment, which amounted to 3.23 (kg). As for the intervention between organic and chemical fertilizer, it was noted that the addition treatment at the O2M2 level was superior, which recorded the highest plant weight of 4.65 (kg)compared to the control treatment O0M0, which recorded the lowest plant weight of 2.80 (kg).

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Table (7) shows the effect of chemical and organic fertilizer on plant weight (kg)

Average effect of chemical fertilization	Organic fertilization treatments			Chemical fertilization treatments
	O2	O1	O0	
3.23 C	3.60 cde	3.30 e	2.80 F	M0
3.58 B	4.00 bc	3.55 de	3.20 E	M1
4.25 A	4.65 a	4.25 b	3.85 bcd	M2
Average effect of organic fertilization	4.08 a	3.70 b	3.28 C	

*Note: There are no significant differences between values followed by the same letter according to Duncan's multinomial test

Interpretations

The results of tables (1, 2, 3, 4, 5, 6, 7) indicated that there was a significant superiority in vegetative and flowering characteristics when using organic fertilizer. This superiority may be due to the organic fertilizer containing nutrients that help in plant growth and increase the activity of the plant process. Photosynthesis and the construction of carbohydrates and their accumulation. This result may also be due to the ability of organic fertilizer to increase the efficiency of the work of the stomatal system and use water more efficiently, thus increasing the rate of the photosynthesis process, which has a positive effect in increasing the nutrients absorbed by the plant, and this is reflected in increasing and improving Plant yield (7) is consistent with the findings of (8)

The results of tables (1, 2, 3, 4, 5, 6, 7) showed that there was a significant superiority in the vegetative and floral characteristics of the shrub rose plant, represented by plant height, number of flowers, number of leaves, chlorophyll percentage, stem thickness, and plant weight. When adding the compound chemical fertilizer NPK, the reason for this increase may be attributed to the important role of the major elements present in the fertilizer, which have an important and direct role in plant growth, as nitrogen nutrition works to regulate the work of plant hormones (auxins and cytokinins), which increases meristematic cell divisions. This is reflected positively on the root system and the increase in the shoot, which helps in increasing the efficiency of the plant to absorb water and nutrients from the soil and assimilate them, thus increasing the harvest (9,14). Phosphorus also plays an important role in cell division and thus contributes to the development of the roots, which works to help in their spread and

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contributes. Also in the absorption of nutrients (10). As for the role of potassium, it contributes to regulating the moisture balance in plant tissue and maintains cell swelling. It is also involved in many physiological processes in plants, such as photosynthesis, the transfer of sugars within the plant, and activating the work of enzymes, if present. Potassium affects more than 91 enzymes, and the lack of potassium in the plant reduces the plant's resistance to drought and decay and reduces the plant's resistance to diseases and insects, thus leading to a healthy and strong plant that leads to a healthy and high-quality yield (11,12). These results are spent with What was achieved by (13) when adding chemical fertilizer to Soil of shrub rose plant.

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